

Preoperative Angiography and Embolization of Large Pelvic Tumors

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Background and Objectives: Pelvic tumors are often large and difficult to excise with appropriate surgical margins due to their size, proximity to neurovascular structures, and major intraoperative bleeding. The purpose of this study is to evaluate the yield of preoperative angiography and embolization so as to facilitate achievement of good surgical results.

Methods: Eighteen patients who suffered from large pelvic tumors (average size, 10.7 cm × 8.3 cm × 3.7 cm), 15 primary and 3 metastatic, underwent surgery at our institution between 1990 and 1995, after preoperative angiography and embolization of the tumors.

Results: The efficacy of the procedure was high. In all but one patient, the grade of vascularity of the tumor was reduced by at least two levels (based on our new tumor vascularity scale. In most patients, appropriate surgical margins were achieved. The average perioperative blood loss was only 750 cc. Procedure-associated complications were negligible.

Conclusions: The results of this study call for the use of angiography and embolization in the management of patients with large pelvic tumors.

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KEY WORDS: pelvic tumors; angiography; embolization

INTRODUCTION

The surgical oncologic treatment of large pelvic tumors often poses difficulties and challenges to the treating team. First, the pelvic tumors are often relatively large at presentation. Second, proximity to major neurovascular structures (e.g., iliofemoral trunk, sciatic nerve) complicates wide surgical margin resection. Third, a rich vascular net at the pelvic region and of the tumor itself may often pose major perioperative bleeding and its associated complications [1–3]. These are not directly related to its size, but more to its location, vascularity (estimated by imaging), and estimated magnitude of surgical resection.

Efficient preoperative angiography and embolization, as presented in this study, can significantly reduce these hazards and facilitate safe, appropriate tumoral resection.

MATERIALS AND METHODS

Eighteen patients with large musculoskeletal pelvic tumors were prospectively treated by preoperative angiography and embolization at our institution between 1990 and 1995. The group comprised 10 females and 8 males, with an average age of 56.2 years (range, 32–83 years).

The primary tumors were as follows: bone—Ewing sarcoma, 4; giant cell tumor, 2; hemangiopericytoma, 2; recurrent aneurysmal bone cyst, 1; soft-tissue malignant fibrous histiocytoma, 3; fibrosarcoma, 2; hemangioma, 1.

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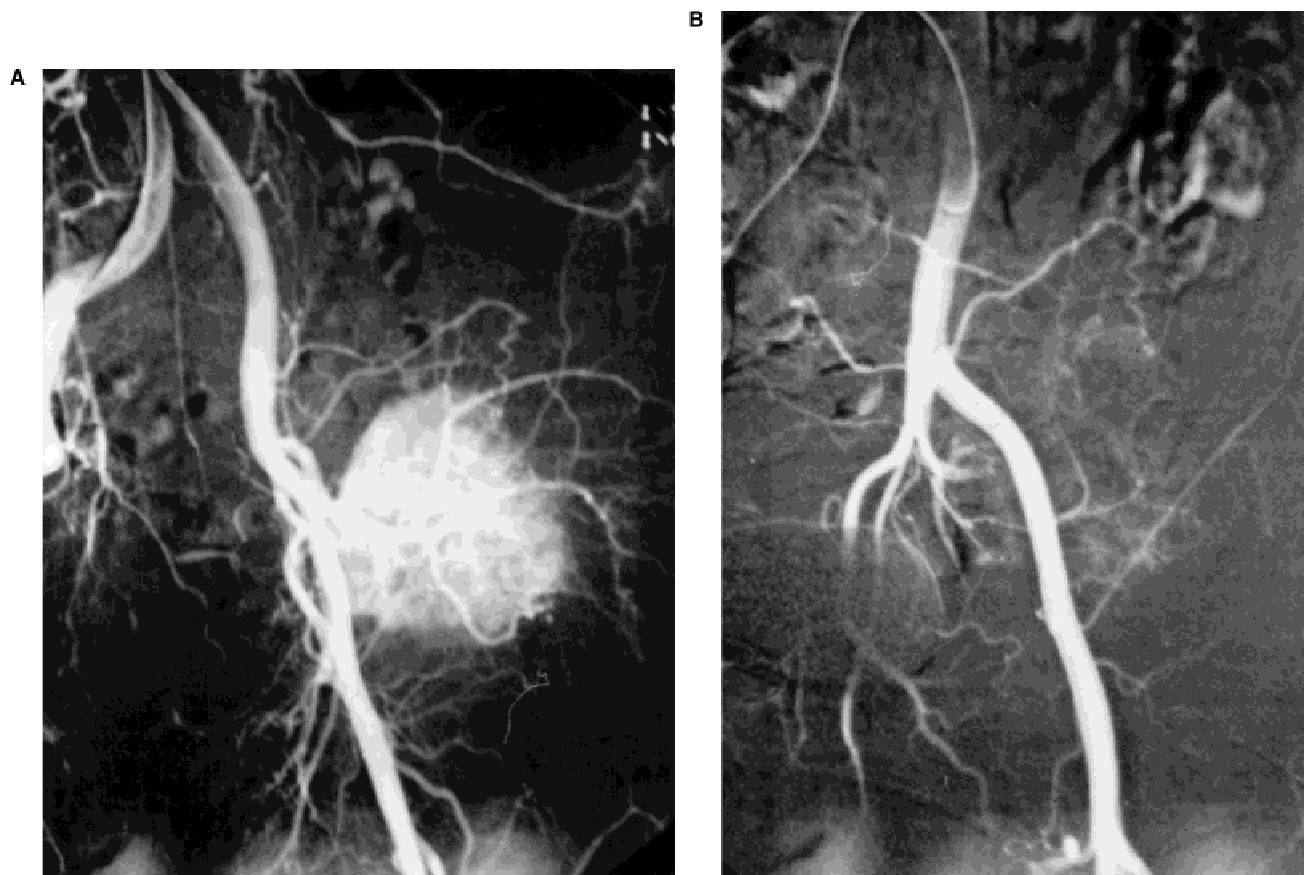


Fig. 1. (A) Hypervascular periacetabular tumor (hemangiopericytoma) of the right hemipelvis. (B) Mild vascularity postembolization in a 55-year-old patient.

Six bony tumors were confined to the ileum, and three soft-tissue tumors to the sacrogluteal region. The bony metastasis originated from the kidney in two cases and from the thyroid in one. The average tumor size measured by computed tomography (CT) and magnetic resonance imaging (MRI) scans was 10.7 cm \times 8.3 cm \times 3.7 cm.

Angiography and embolization were performed 12–48 hr prior to surgery. Three methods of embolization were used: gel foam, metal coils, and cyanoacrylate injection. Gel foam particles were used in medium-sized vessels where it was possible to perform super selective embolization via a 5 Fr catheter, or a combination of gel foam and coils in hypervascular tumors with large feeding vessels.

Cyanoacrylate was used in cases of hypervascular tumors with very small vessels, which were approached super selectively by 3 Fr catheters. Gel foam alone, combined gel foam and coils, and cyanoacrylate were used in 3, 11, and 4 cases, respectively. The number of feeding vessels to each tumor was recorded, and the method of embolization was also adjusted according to this parameter. There were seven tumors with one or two feeding vessels, eight with up to four, and three with

more than four vessels. Pre- and postembolization vascularity was classified on a five-grade scale, from 0 (avascular) to 4 (hypervascular), estimated independently by three experienced invasive radiologists.

Perioperative blood loss was measured from the suction drainage and pad weight during surgery and from the suction drainage postoperatively. Drainage tubes were invariably removed after 48 hr.

RESULTS

All the pelvic tumors were graded prior to embolization as highly, or hypervascular, i.e., grades 3 and 4, respectively. After embolization, eight tumors were graded as avascular (grade 0), nine as mildly vascular (grade 1), and only one as moderate (grade 2).

The only minor complications associated with the procedure were local gluteal rash in a patient who received intra-arterial Adriamycin prior to embolization, and puncture site hematoma in another patient which was treated by application of pressure bandage. No other adverse reactions were recorded.

The average blood loss was 750 cc, ranging from 350 to 2,100 cc. The resection margins, judged by intraoperative frozen sections and confirmed by final histologic

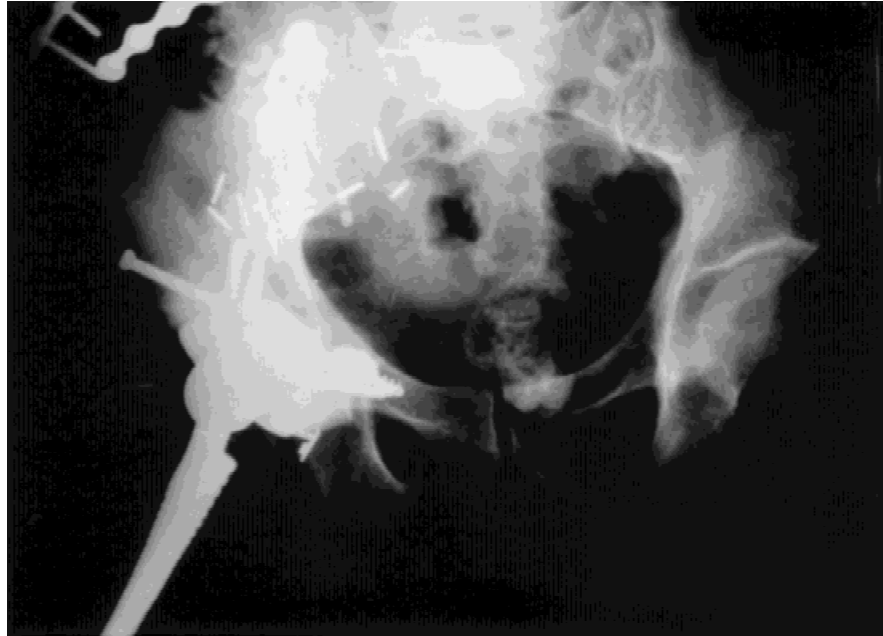


Fig. 2. Reconstruction postinternal hemipelvectomy by massive hemipelvic allograft and total hip arthroplasty.

examinations of the resected tumors, were wide margins in 11 cases, marginal margins in 4, and intralesional margins in 3.

The surgical procedures undertaken after tumor resection were resection only (nine cases); resection and cancellous bone grafting (three cases); resection and massive bone allograft reconstruction (six cases, including one case of internal hemipelvectomy and "composite" allograft and hip arthroplasty reconstruction) (Figs. 1 and 2).

All the patients were followed up for 24–56 months postoperatively. The demise of four patients occurred during this period: one with Ewing sarcoma, two with fibrosarcoma, and one with renal cell carcinoma. The remaining 14 patients are alive and functioning, 3 with controlled disease and 11 free of disease.

DISCUSSION

During the last decade, because of computed tomography (CT) and magnetic resonance imaging (MRI), angiography no longer plays a major role as an imaging modality. Most of the reports in recent years discuss its role mainly in the spine, while reports on its use in the pelvic region are sporadic. Furthermore, routine use in the management of pelvic tumors is not discussed [1–4], although the pelvis is a favored location for many tumors.

Nevertheless, as shown in our study, angiography serves as a major adjuvant modality to the surgical management of patients with large pelvic tumors. These tumors are often immense and reach their enormous sizes due to late detection: unlike tumors of the axial skeleton, where early detection is feasible and the average size of

which is far smaller on detection, i.e., $4.8 \text{ cm} \times 3.6 \text{ cm} \times 3.1 \text{ cm}$ average, compared to $10.7 \text{ cm} \times 8.3 \text{ cm} \times 3.7 \text{ cm}$ in our patients. Furthermore, axial tumors can often be managed by radical resection (i.e., amputation), whereas external hemipelvectomy is associated with high complication rates and a severely debilitating condition [5].

Appropriate surgical resection margins, response to preoperative chemotherapy, and histologic grading are some of the most important parameters for survival in patients with malignant, musculoskeletal tumors. Correlation was found in our patients between the degree of vascularity and the histologic grading of tumors; all the malignant tumors were graded as hypervascular (grade 4). Preoperative angiography and embolization had successfully reduced the vascularity grade of the tumors by at least two levels. In relation to the average tumor sizes, in our patients a perioperative blood loss of 2–3 liters was estimated. From the surgical point of view, it is unquestionable that the rate of complications or failure to achieve good surgical margins are in direct proportion to bleeding. This correlates with the bleeding reported in the literature [1–3].

Thus, bleeding and transfusion-related complications were prevented following embolization. More importantly, good surgical margins were achieved in most patients with malignant tumors, as reflected by the survival rate. Since the numbers of patients in each modality of embolization used are too small, no statistical conclusions can be reached concerning the advantages of either method over others [6–10]. In most cases, angiography has added an important (and frequently forgotten) dimension to the imaging of the tumor and its related structures.

It should be noted, as shown in our study, that most tumors have several "feeding vessels," and each should be embolized meticulously by utilizing the appropriate embolization method, even if this is often a very time-consuming procedure.

In conclusion, although the number of cases in these series are relatively small, it seems that preoperative angiography and embolization is a safe procedure that offers an important means of controlling bleeding and enhances the achievement of good surgical resection results.

The results presented here call for routine utilization of angiography and embolization for the management of patients with large musculoskeletal tumors confined to the pelvis.

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